

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Kittaka

Serial No. (not assigned)

Examiner (not assigned)

Filed concurrently herewith

Art Unit (not assigned)

For OPTICAL DEVICE AND SPECTROSCOPIC AND POLARIZATION
SEPARATING APPARATUS USING THE SAME

Assistant Commissioner of Patents

Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Prior to calculation of the filing fee, Applicant wishes to amend the application as follows:

In the Claims:

Please amend claims 18-27 as follows (a marked up version of claims 18-27 being appended hereto):

18. An optical device according to Claim 14, wherein said coupled band is a second coupled band from a lowest-order band.

19. An optical device according to Claim 14, wherein a condition given by an expression:

$$\cos 60^\circ \leq k_s \cdot \lambda_o / (2\pi \cdot n_s) \leq \cos 20^\circ$$

is satisfied.

20. An optical device according to Claim 14, wherein said k_s satisfies a condition:

$0.9k_1/m \leq k_s \leq 1.1k_1/m$ (m is an integer not smaller than 2)

when k_1 is a magnitude of a wave vector of the lowest-order coupled band.

21. An optical device according to Claim 14, wherein said medium tangent to said surface of said multilayer structure provided as said beam incidence surface or as said beam exit surface is air or vacuum.

22. An optical device according to Claim 14, wherein:

said periodic multilayer structure is an optical multilayer film in which one structure formed on a transparent substrate is repeated periodically with respect to a wavelength used; and

a surface of said multilayer film tangent to said substrate is provided as said beam incidence surface or as said beam exit surface.

23. An optical device according to Claim 14, wherein said one period in said periodic multilayer structure is constituted by layers formed out of difference materials.

24. An optical device according to Claim 14, wherein a layer varying continuously in terms of composition or characteristic is contained in a boundary between every two layers constituting said periodic multilayer structure.

25. An optical device according to Claim 14, wherein a ratio of a maximum refractive index of a plurality of materials constituting said periodic multilayer structure is not smaller than 1.1 in a wavelength used.

26. A spectroscopic apparatus comprising an optical device constituted by a periodic multilayer structure as defined in Claim 14, means for making a mixture of various luminous flux having a plurality of wavelengths incident on an end surface of said multilayer structure of said optical device, and means for detecting beam rays made to

exit from a surface of said multilayer structure at different angles in accordance with the wavelengths.

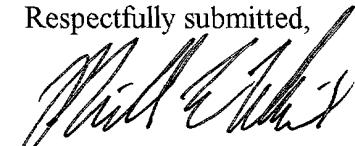
27. A polarization separating apparatus comprising an optical device constituted by a periodic multilayer structure as defined in Claim 14, means for making a mixture of various luminous flux having a plurality of wavelengths incident on an end surface of said multilayer structure of said optical device, and means for detecting beam rays made to exit from a surface of said multilayer structure at different angles in accordance with polarized beam components.

REMARKS

The amendment avoids multiple dependent claim language and does not introduce new matter.

Please proceed to examination on the merits.

Respectfully submitted,



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Marked-Up Version of the Claims

Claim 18 (once amended). An optical device according to Claim 14 [or 17], wherein said coupled band is a second coupled band from a lowest-order band.

Claim 19 (once amended). An optical device according to Claim 14 [or 17], wherein a condition given by an expression:

$$\cos 60^\circ \leq k_s \cdot \lambda_o / (2\pi \cdot n_s) \leq \cos 20^\circ$$

is satisfied.

Claim 20 (once amended). An optical device according to Claim 14 [or 17], wherein said k_s satisfies a condition:

$$0.9k_1/m \leq k_s \leq 1.1k_1/m \quad (m \text{ is an integer not smaller than } 2)$$

when k_1 is a magnitude of a wave vector of the lowest-order coupled band.

Claim 21 (once amended). An optical device according to Claim 14 [or 17], wherein said medium tangent to said surface of said multilayer structure provided as said beam incidence surface or as said beam exit surface is air or vacuum.

Claim 22 (once amended). An optical device according to Claim 14 [or 17], wherein:

 said periodic multilayer structure is an optical multilayer film in which one structure formed on a transparent substrate is repeated periodically with respect to a wavelength used; and

 a surface of said multilayer film tangent to said substrate is provided as said beam incidence surface or as said beam exit surface.

Claim 23 (once amended). An optical device according to Claim 14 [or 17], wherein said one period in said periodic multilayer structure is constituted by layers formed out of difference materials.

Claim 24 (once amended). An optical device according to Claim 14 [or 17], wherein a layer varying continuously in terms of composition or characteristic is contained in a boundary between every two layers constituting said periodic multilayer structure.

Claim 25 (once amended). An optical device according to Claim 14 [or 17], wherein a ratio of a maximum refractive index of a plurality of materials constituting said periodic multilayer structure is not smaller than 1.1 in a wavelength used.

Claim 26 (once amended). A spectroscopic apparatus comprising an optical device constituted by a periodic multilayer structure as defined in Claim 14 [or 17], means for making a mixture of various luminous flux having a plurality of wavelengths incident on an end surface of said multilayer structure of said optical device, and means for detecting beam rays made to exit from a surface of said multilayer structure at different angles in accordance with the wavelengths.

Claim 27 (once amended). A polarization separating apparatus comprising an optical device constituted by a periodic multilayer structure as defined in Claim 14 [or 17], means for making a mixture of various luminous flux having a plurality of wavelengths incident on an end surface of said multilayer structure of said optical device, and means for detecting beam rays made to exit from a surface of said multilayer structure at different angles in accordance with polarized beam components.